

Impact of Environment, Stress, Occupational, and Other Hazards on Sexuality and Sexual Behavior

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Sexual health is important for general as well as reproductive health. The effects of the environment on sexual health are complex, however, because of the psychosomatic nature of human sexuality. The effects of any specific environmental agent on sexual function will therefore be modified or amplified by psychosocial factors, and any assessment of the effects of the agent will need to take those factors into account. As a consequence, we have little direct evidence of the adverse effects of the environment on sexuality. This paper therefore considers *a*) the aspects of sexuality that may be susceptible to environmental effects and the likely mediating mechanisms. These are considered under three headings: psychophysiological, endocrine, and subjective/interpersonal; *b*) the types of relevant environmental factors, including toxic pollutants, self-administered toxins, diet, situational factors, adversity, stress, and social and cultural factors. As yet research has not controlled adequately for the various confounding factors. It is suggested that a first step is to investigate the effects of work stress (e.g., shift and night work) on sexual relationships, comparing the effects across contrasting cultural settings. Such research would then provide a basis for cross-cultural study of other environmental factors.

Introduction

The concept of "sexual health" is difficult to define. A previous World Health Organization workshop in Copenhagen dedicated to the task was unable to produce a simple definition that could be applied across contrasting cultures and religious systems. A sexual lifestyle seen as healthy in one culture might be regarded as of revolutionary significance in another. This was particularly relevant when considering the relative roles of men and women in a healthy heterosexual relationship. On the other hand, there was general agreement that, within the cultural context, sexual health was important for general health. The health benefits of a rewarding and secure sexual relationship are considerable, not just in fostering a close supportive relationship which protects the partners in the relationship from many of life's stresses, but also in the more tangible form of prolonged life expectancy. A chaotic sexual lifestyle is likely to result in sexually transmitted disease with a variety of adverse consequences for reproductive health. It is therefore entirely appropriate to consider how environmental influences might adversely affect sexual health. But the task is a difficult one.

In attempting to understand the impact of any specific environmental influence on human sexual function, it is important to be aware of the complex psychosomatic nature of human sexuality (1). Whereas, in the case of fertility, it is possible to study the effects of specific agents on such parameters as sperm density or motility, most of the measurable parameters relating to sexual function are influenced by a wide variety of factors, often involving psychosomatic interactions. Such factors include attitudes to sexuality, the effects of previous learning, the quality of the current sexual relationship, as well as physiological mechanisms.

As a consequence of this complexity, the adverse effects of a specific, directly acting environmental factor, such as a neurotoxin, may be obscured or distorted. For example, a relatively mild effect of a toxic agent may result in slightly impaired erectile function in one man who remains unconcerned by the change, and who continues in his sexual relationship relatively unaffected. The same degree of impairment in another man, who is unduly concerned about his erectile performance, may initiate a state of "performance anxiety" that will make the erectile problem much worse than it need be. Adequate evaluation of such effects would therefore require fairly detailed assessment of a man's sexual function, including his previous sexual performance, his current psychological state, and his function after withdrawal from exposure to the noxious substance. It would also be crucially important to have an appropriate control group; sexual problems, particularly

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those of a transient kind, are quite common, and it is easy to be misled by the prevalence of sexual difficulties in a particular group if there are no appropriate controls.

Direct and Indirect Environmental Effects

Apart from the effects of directly acting environmental agents, we also have to consider the many indirect ways that environmental factors may impinge on sexual health. Any state of general malaise is likely to be associated with loss of sexual desire and responsiveness, without specific sexual effects being involved. In such circumstances, it is unlikely that the sexual deficits will be in the forefront of the individual's mind, though they can be presented as a problem, particularly when sexual deficits result in tensions and conflicts within the relationship. In a similar way, depression is typically associated with loss of sexual desire, and other negative psychological consequences for self-esteem that can affect the sexual relationship.

Fatigue and psychosocial stress are notorious for impairing sexual relationships, though, at our present level of knowledge, we can say no more than that they preclude the optimum circumstances for the expression of normal, healthy sexual feelings. Factors that interfere with sexual intimacy, such as overcrowding or unsuitable temperatures, can also take their sexual toll.

In considering the relevant evidence, it can be stated at the outset that the evidence of direct specific effects of environmental agents on sexuality is extremely limited. Most available data are inadequate because of failure to consider the complexity described above or to involve appropriate control groups. The evidence for indirect effects is of a different order. Although there is little evidence specifically addressing the link between, say, stress and sexual functioning, there is a substantial amount of indirect or suggestive evidence to justify investigating such links.

This paper therefore has limited objectives. It aims to *a*) define the components of human sexuality that might be vulnerable to environmental hazards, *b*) consider the types of environmental hazards that might be relevant, and discuss some of the methodological problems in assessing their effects, *c*) suggest examples of appropriate research objectives for the future. The effects of drugs used for medical purposes are not considered. Some consideration will, however, be given to factors over which the individual does have some control, such as alcohol and recreational drugs.

Relevant Components of Human Sexuality

These can be considered under three headings: psychophysiological (e.g., peripheral sexual responses), endocrine factors and sexual response, and subjective and relationship factors.

Psychophysiological Factors

There is a crucial distinction to be made between genital responses, necessary for functional sexual interaction

(e.g., penile erection in the male and vaginal lubrication and vulval tumescence in the female), and orgasm, or in the case of the male, ejaculation (which is the combination of orgasm and seminal emission). In both men and women, genital responses depend on specialized vascular mechanisms under neural control. The vulnerability of the male's genital response appears to be greater than that of the female. For a man it is crucial to develop sufficient rigidity of erection for vaginal entry, and there is no adequate substitute for a full erection. For a woman, lack of vaginal lubrication, the physiological equivalent in the woman of penile erection, although not unimportant for sexual well being, can be compensated for more readily by means of lubricating creams or jellies. Also, the specialized physiological mechanisms involved in erection, in particular the elimination of venous outflow from the corpora cavernosa, are more susceptible to pathological processes. For these various reasons, it is much less common for women than for men to complain of impaired genital response as a result of physical disease. Arterial disease, especially that affecting the small vessels of the penis, and neurological disease, especially autonomic neuropathy or damage to the spinal cord (e.g., traumatic or demyelinating diseases), commonly result in impairment of erectile response. Erectile failure can be the first symptom of vascular disease and not uncommonly precedes the first myocardial infarction in a man with ischemic heart disease. In conditions such as diabetes mellitus, it is also possible for erectile failure to be the first symptom of autonomic neuropathy. It is unusual, however, for demyelinating diseases to present with erectile failure as an isolated symptom. Apart from such pathological structural changes, functional disorder of sexual response has to be considered. Although we have learned a great deal about the physiology and pathophysiology of erection in the past few years, the precise pattern of neurotransmitter control of the specialized vascular mechanisms remains unclear (1).

The physiology of orgasm is not well understood in either men or women, and direct effects of neurological disease on this phenomenon have not been clearly identified. This uncertainty partly stems from the probable fact that orgasm has both a central and peripheral (i.e., spinal cord) component. Men and women with transection of the spinal cord can experience "phantom" orgasms in the absence of any genital sensation. Seminal emission, however, is clearly under the control of the lumbar sympathetic outflow, and either damage to these fibers or interference with their function by adrenergic blocking drugs can prevent emission.

Penile erection, vaginal lubrication, and orgasm are all readily affected by psychological mechanisms, making the precise analysis of their failure difficult. Seminal emission is less problematic in this respect, and some of the clearest instances of pharmacological interference of sexual response involve impairment of seminal emission (NB, premature ejaculation is rarely if ever caused by physical factors).

It is conceivable that a noxious environmental agent could result in erectile failure either by inducing vascular disease or neurological damage, or in a more transient

sense, by interfering with neurological transmission. A crucial question is whether such disease processes might present with exclusively sexual symptoms, as there is no reason why the effects of such damage should be confined to the genital responses. As far as structural damage is concerned, sexual manifestations may be the first to present, as we have seen, but other manifestations of such pathology should be expected sooner or later. It is feasible that a toxic agent could result in a functional disturbance limited to the specialized sexual response mechanisms, although no evidence of such an effect has been reported. It is also theoretically possible that an environmental noxious agent could interfere with vaginal lubrication, causing dyspareunia, and as a consequence other negative psychological reactions to sexual interaction. Such an effect is not unusual with some hormonal treatments, or as a result of vaginal infections.

Endocrine Factors

The relevance of hormones to human sexuality is crucial to our topic. Elsewhere in this workshop much attention is given to the effects of environmental hazards on spermatogenesis and oogenesis. It is therefore also pertinent to consider the effects on the endocrine functions of the gonads. In fact, the hormonal function of the testis (i.e., testosterone production) appears to be less susceptible to external noxious agents than its spermatogenetic function. In the ovary, the hormonal and oogenetic functions are more intimately interrelated than is the case in the testis. Let us therefore consider what the sexual consequences might be of impairing hormonal function of either the testis or the ovary.

Hormones and Male Sexuality. The evidence for men is now relatively clear (2). Androgens are necessary, though not sufficient, for normal sexual desire. They are also necessary for normal seminal emission. Their role in erectile function is more complex. Spontaneous erections during sleep (i.e., nocturnal penile tumescence or NPT) are androgen dependent. They are impaired in states of androgen deficiency and restored with androgen replacement. Erections in response to visual stimuli, however, are not androgen dependent; they continue in states of androgen deficiency and are not improved by androgen replacement.

It is therefore apparent that erections can occur in states of androgen deficiency providing the right type of stimulation occurs. It is not yet known whether the erectile response to tactile stimulation is androgen dependent. The fact that NPT is androgen dependent does increase the likelihood that spontaneous erections during the waking state may be impaired in states of androgen deficiency, though erectile response should still be possible. However, the occurrence of such impairment, together with the loss of sexual desire that is to be expected with androgen deficiency, could well lead to a psychogenically induced erectile failure. It is reasonable to assume, however, that any environmental hazard that results in a significant reduction in testosterone production will result in some

sexual impairment, but loss of sexual desire will be the most predictable feature of such an effect.

Hormones and Female Sexuality. The role of hormones in the sexuality of women is much less clear than is the case for men (1). Although we have much more evidence of hormone-sexual behavior relationships for women than for men (there are many more opportunities for studying such relationships in women), this evidence is inconsistent and often contradictory. Estrogens are clearly necessary for normal vaginal response, which is often impaired in the hypo-estrogenized states associated with lactation and post-menopause, although the majority of lactating and postmenopausal women appear to have enough estrogen to avoid such problems. The role of estrogens in sexual desire and enjoyment is much less clear. Testosterone appears to be related to sexual desire in women, but again the evidence is inconsistent. Some women appear to function sexually and maintain sexual desire with low levels of testosterone. The majority of women who use steroidal contraceptives, which suppress ovarian activity and lower free testosterone substantially, are not adversely affected in their sexual lives, whereas a minority, possibly quite small in size, clearly are affected (3). In general, it appears that the effects of gonadal hormones on women's sexuality are easily obscured or counteracted by psychosocial factors; much more so than is the case with men. It is also possible that women are much more variable than men in their behavioral responsiveness to gonadal hormones.

As a result, it is difficult to predict what sexual effects might ensue as a result of environmental hazards interfering with ovarian function. Paradoxically, there is evidence suggesting that sexual behavior has a beneficial effect on ovarian function: women with regular sexual activity are more likely to have regular and fertile menstrual cycles (4), but evidence of the reverse is hard to find.

Subjective and Relationship Factors. SEXUAL DESIRE. This is a difficult concept to define and to study. An individual's experience of sexual desire or appetite results from an interaction between a neurophysiological substrate for sexual arousal, cognitive processes that focus attention on to erotic cues, and the occurrence of erotic cues or stimuli in the individual's environment. The experience of sexual desire requires not only the occurrence of relevant thoughts, but also an associated, characteristically erotic, type of arousal accompanying those thoughts. The neurophysiological substrate of that arousal, as has already been described, is probably dependent on hormones, at least in the male. There are also other biochemical factors that can adversely affect this component such as metabolic disturbances associated with illness or following trauma. There is an important association between depressive illness and low sexual desire (5), and it is common for loss of sexual desire to start during a depressive illness and to continue after the depression has resolved. The relationship between depression and sexual desire is likely to be complex. It can be considered at a purely cognitive level: the persistence of depressive thinking, associated with low self-esteem, inertia, and a poor body image is incompatible, for most people, with normal sexual interest and responsiveness. However,

it is possible that there are biochemical changes that link depressive mood with sexual arousability. Thus, men with depressive illness typically show impaired NPT, which returns to normal after the depression has lifted. This indicates a noncognitive link of some kind, which may involve alteration in neurotransmitter activity in the brain.

Apart from depressive illness, there is also evidence linking well being with sexual interest. This is particularly evident in women who experience significant variation in well being during their menstrual cycles. Such women typically experience more sexual desire when their well being is high and low sexual desire when it is low (6). In general, therefore, we should expect sexual desire to vary with circumstances that affect well being.

SEXUAL INTIMACY. For most men and women, the optimum expression of their sexual feelings and experience of sexual pleasure and fulfillment requires a sexual relationship in which they feel emotionally secure and where there is a sense of intimacy. This emotional security can be affected in a variety of ways. The behavior of one partner may provoke either insecurity (e.g., threats of infidelity) or resentment, which will impair the sexual intimacy. Overcrowding and unsuitable circumstances frequently spoil intimacy or even prevent it from becoming established. Disruption of the sexual relationship is common for migrant workers, and in many societies, poverty encourages the use of sex for material gain, with all the associated risks, both physical and psychological.

SEXUAL ORIENTATION. Sexual orientation is mentioned in order to dismiss it as largely irrelevant to this paper. The determinants of sexual orientation, in particular why most people develop predominantly heterosexual and a minority predominantly homosexual preferences, is not well understood (1). It has been suggested (7) that psychological stress to the mother during pregnancy increases the likelihood of homosexual orientation developing in male offspring. The evidence on which this assertion was based (relating to the numbers of homosexual men who were born in Germany during the Second World War) has been criticized and largely refuted (8). At the present time, apart from the importance of cultural attitudes to masculinity/femininity, and the theoretical possibility that naturally occurring estrogens might interfere with normal sexual differentiation, there is no reason to suppose that environmental factors would influence the development of sexual orientation per se.

Types of Environmental Hazards

Toxic Pollutants

Steen and Pangkahila (9,10) reviewed a variety of occupational influences which might affect fertility or sexuality. These included physical factors (e.g., temperature, radiation, microwaves, chemical factors, and psychological factors (such as occupational stress).

Microwaves. Of 31 men with long-term exposure to microwaves, 70% reported sexual disturbance "as part of an asthenic syndrome." Neither the asthenic syndrome nor the type of sexual disturbances were described, and

methods of assessment were not given. There were no controls. Urinary excretion of 17-keto-steroids and gonadotrophins were unaffected (11).

Radiation. One hundred Bulgarian men who had been exposed to radiation for a minimum of 3 and an average of 8 years were compared with 100 clinically healthy men. In the exposed group there were 29 cases of reported decrease in libido, compared with only one in the controls. The method of assessing sexual function or libido was not given, and there was no mention of other possible effects to health that might have affected sexuality indirectly. It is possible that Leydig cell function may have been affected, but testosterone levels were not reported (12).

Industrial Chemicals. Lacranjan et al. (13) reported possible effects of lead poisoning on sexual function in men exposed to lead in a dry-battery plant. They divided their subjects into four groups: those with clear lead poisoning ($n = 23$), those with moderately raised lead absorption ($n = 42$), those with slightly increased lead absorption ($n = 35$), and "men working in a polluted environment but with physiological levels of lead" ($n = 50$). In the first group, 48% reported "erection troubles" compared with 14% in last group, the other two groups being intermediate. The authors dismissed this result as inconclusive. The evidence for lowered libido, ejaculation, or orgasm problems was even less convincing.

These researchers (14,15) also studied the effects of carbon disulfide poisoning in workers in an artificial fiber factory in Bucharest. Sexual disturbances, particularly loss of sexual desire, erectile, and ejaculatory problems, were substantially more common in those with evidence of poisoning (most subjects in this group had clinical evidence of a polyneuritis). In two thirds of cases, there was improvement in the sexual disturbance after removal from the toxic environment. A relationship was found between the duration of exposure to the toxin and the decrease in urinary 17-ketosteroids and gonadotrophins. Testicular biopsies showed not only spermatogenic arrest but also Leydig cell insufficiency. These authors therefore concluded that both gonadal and hypothalamic effects were involved.

Pesticides and Herbicides. Four out of five English workers using pesticides on a particular farm developed erectile problems without obvious loss of sexual desire (16). In each case there was subsequent recovery. As a variety of pesticides were being used, no particular compound could be implicated, though the organophosphorus compounds were under particular suspicion. The subjects were apparently casual about their use of protective clothing.

Hormone Manufacture. Of 25 male employees in an oral contraceptive factory, 5 (20%) had gynecomastia, with 3 of the 5 reporting loss of libido and erectile problems (17). Other similar reports were also cited. It has become widely recognized that steroid hormones can be readily absorbed in industrial and laboratory settings, and considerable care is now normally exercised.

In none of these reports does there appear to be a satisfactory evaluation of sexual and psychological function that would allow assessment of the specific effect of the supposed toxin. It is also noteworthy that all of the

reported toxic effects on sexuality involved men. It is not clear whether this reflects a failure to assess sexual function in women workers or whether they are less vulnerable in this respect. However, several of these reports of male subjects are suggestive of a direct effect on sexual function, either by lowering testosterone levels or possibly by neuropathy. In other cases, it is not clear to what extent the sexual disturbance is best understood as part of a more generalized malaise or a more specific peripheral neuropathy. The most convincing examples involve levels of exposure that one would hope are no longer likely to occur, at least in any country with a semblance of regulation of such matters. In more adequately controlled circumstances, sexual effects may be more subtle and require appropriately sensitive studies to identify them. The most recent report cited was in 1978. A literature search has so far been unsuccessful in finding more recent reports of such pollutant effects on sexual function.

Self-Administered Toxins

The adverse effects of alcohol and nicotine on sexual function, although increasingly well established, are complex. In both cases we have to consider the direct pharmacological effect on sexual function as well as the longer-term indirect effects resulting from tissue damage.

A dose-response relationship between blood alcohol and genital response (and orgasm) has been demonstrated in both men and women, with decreased responsiveness with higher blood alcohol levels. The effects are complicated, however, by the effects of expectation and attribution. Both men and women tend to regard themselves as more sexually aroused in a sexual situation if they believe they have consumed alcohol, whether or not they have. However, men's assessment of their sexual arousal under the influence of alcohol is modified by their ability to obtain an erection, which is impaired by alcohol, whereas women continue to regard themselves as sexually aroused even when their genital responses are substantially impaired (1,18).

Apart from the pharmacological effects of alcohol, long-term effects of alcohol abuse that can impinge on sexual function include peripheral and autonomic neuropathy, suppression of testicular function, and liver damage, which alters hormone metabolism (19). The psychological consequences of chronic alcohol abuse are also considerable, causing havoc with the sexual relationship, resentment in the partner, and often withdrawal by the partner from the sexual relationship.

Nicotine was shown to impair erectile response to erotic stimuli in a study of men (20) and also to impair erectile response to intracavernosal papaverine (21). No comparable studies have been reported with women. However, the chronic effects of smoking in increasing small vessel vascular disease are well established, and a number of studies have reported a high proportion of smokers among men with erectile dysfunction (22). As yet there is no evidence relating to the effects of "passive" smoking, (i.e., working or living in an environment with much cigarette smoke) on sexual function.

Diet

It is reasonable to consider diet in two ways. First, are there dietary constituents that may play a specific role in sexual function, deficiencies of which may result in sexual impairment? Second, in what ways might unsatisfactory diet cause disease that secondarily effects sexual function?

In the first case there is little to say. I know of no trace element or vitamin deficiencies or excesses that specifically impair sexual function. Zinc, which features in many enzyme systems and is important in spermatogenesis, is of possible interest. In certain areas where zinc deficiency in the soil is endemic, impaired or delayed sexual maturation may result. Also, in men with renal failure, on renal dialysis, zinc deficiency resulting from the dialysis has been shown to be related to erectile impairment (23). Other effects of dietary deficiencies may affect sexual function as part as a more generalized effect (e.g., neuropathy from vitamin B deficiencies).

In the second case, the most obvious factor is the atherogenic, high-fat diet, which, particularly when associated with a stressful lifestyle, may lead to atherosclerosis and in some cases impairment of the penile vasculature leading to erectile failure. Dietary deficiency may interact with other hormonal mechanisms during lactation in women. In conditions of poor diet, lactation is associated with greater ovarian suppression, suggesting an adaptive mechanism that prevents further pregnancy in conditions of nutritional inadequacy.

Situational Factors

As mentioned earlier, there are a variety of situational factors that impinge on sexual behavior and hence sexual health. Overcrowding, the lack of suitable privacy for sexual interaction, and unsuitable climate (either too hot or too cold) are obvious factors, although I am not aware of any systematic studies of the relationship between such factors and sexual health.

Of particular importance is the impact of the work role and timetable. Many people work shifts, and when both partners in a relationship are working, shifts may not coincide. Thus for many couples, work results in little time together. Similarly, many people work night shifts, resulting in an abnormal day that can conflict with that of the spouse. Certain types of work (e.g., North Sea Oil Rig workers) involve the worker being away from home for several weeks at a time, then returning to be with their spouse for several weeks without working. These variations in the working timetable may cause difficulties in sexual relationships.

A common complaint related either to accidents at work or to stressful work conditions is low back pain. Forty-three men with back injuries from industrial accidents were assessed, and 27 (63%) were found to be sexually impotent (24). Unfortunately, the term "impotent" was used to cover erectile dysfunction, loss of sexual desire and ejaculatory problems, and no details of the proportions with each type of dysfunction were given. The impotent group did not differ from the nonimpotent men in terms of

physical signs of neurological damage, but they did report more subjective symptoms and also differed on a number of psychosocial and economic factors, suggesting that the sexual problems were not simply a result of the back problem.

In a more methodologically sound Swedish study of 35 men and 25 women with chronic back pain, an interesting sex difference was reported (25). Substantially more of the women admitted to sexual difficulties prior to their back problem, leading the authors to conclude that back pain may be used to legitimize preexisting sexual difficulties. A third of the men developed erectile and the same proportion ejaculatory problems following the onset of back pain. The authors also concluded that pain or the fear of the pain was the crucial factor in disrupting sexual function and enjoyment in both men and women. These results remind us of the psychosomatic nature of sexuality, discussed earlier. In some cases of back injury, however, damage to the pelvic nerves could result in sexual dysfunction, though careful neurological and sexological assessment will be required to establish such etiology.

Adversity

Adverse circumstances, life events, or chronic problems predispose individuals to depression and hence may adversely effect sexual health. Obviously, such circumstances may have more direct effects on the sexual relationship without producing depression per se as a result of interpersonal conflict. There have been numerous studies of the relationship between adversity and depression, though mainly involving women. I do not know of any that have specifically assessed the effects of adversity on sexual health.

Stress

Stress, in experiential terms, is difficult to define, and this term is often used loosely. We can, however, consider stress as having two particular consequences of relevance: *fatigue, resulting from insufficient rest or sleep and tension or the inability to relax satisfactorily.* Although we lack systematic evidence, there is abundant anecdotal evidence that both factors, (fatigue and difficulty relaxing) have an adverse effect on sexual function. Probably the most direct effect is on sexual desire rather than genital responsiveness. A very common anecdote is for a marked increase in sexual desire in couples when they are on holiday, away from their normal day-to-day pressures. The mediating mechanisms are not understood and are likely to be various. Seyle (26), in his pioneering studies of stress, emphasized the role of the adrenal cortex in mediating between psychological stress and various physiological mechanisms. Direct effects on gonadal function are also possible.

In men, there is evidence that stressful situations of certain kinds (e.g., loss of status, failure in competition) are associated with lowered testosterone levels (27). It is theoretically possible, though not as yet demonstrated, that such an effect could account for loss of sexual desire in some cases (28).

In women, the relationship between stress and ovarian function is poorly understood. The condition of hypothalamic chronic anovulation, arising in conditions of psychological stress, is, however, well recognized. It would appear that the endocrine deficiency lies in the control of cyclic production of gonadotrophins by the hypothalamus rather than an unresponsiveness of the ovary (29). Women whose sexual desire is dependent on gonadal steroids may well experience loss of sexual desire during states of chronic anovulation. There is considerable overlap between situational factors, adversity, and stress. This is most obvious in conditions of poverty.

Social and Cultural Factors

The effects of social, cultural, and religious factors on sexual behavior and sexual relationships are considerable and serve to complicate the effects of the other environmental factors. It is the influence of such factors on the male-female relationship that is probably most important, e.g., the degree of sexual stratification (the extent to which men generally hold more power than women) and sexual segregation (the extent to which men and women lead largely separate lives). It is in this area that we encounter the greatest difficulty in drawing comparisons across cultures and different religious and political systems. It is, in my view, difficult to escape the conclusion that certain types of social system, however much they may conform with the normative expectations of such cultures, are less likely to foster sexual health, or more likely to interact with other environmental factors to impair sexual health. This is a sensitive area, and there is a tendency to evade it in cross-cultural discussions to avoid causing offense. I would suggest, however, that if we are to take the subject of this paper seriously, we must be prepared to "grasp the nettle" and at least discuss such issues. Thus, I would suggest in cultures which reinforce sexual segregation, and where expectations of normal male behavior involve sexual dominance and control of women by men, that sexual relationships that are conducive to good health, i.e., where the intimacy and security of the relationship has a protective effect for both partners, are less likely to occur. Furthermore, in such social circumstances, the sexuality of the individual, perhaps particularly of the woman, may be more susceptible to the adverse effects of stress and adversity. I know of little systematic evidence to support this view. Within the social systems of Western Europe and North America, such effects have been best documented in relation to socioeconomic or social class differences. In an early American study (30) it was shown that lower-class married couples enjoyed less sexual intimacy, and the wives were less likely to be sexually satisfied with their marriages than the wives of middle-class marriages who generally had more shared activities. Among 40-year-old Danish women, sexual problems were more frequent in those from lower socioeconomic groups (31). It is possible that such social class influences, at least within Europe and the the United States, are changing. Certainly, a number of studies of premarital sexual behavior have shown a lessening of the social class difference in

sexual behavior, in particular the "double standard," that was so clearly documented by Kinsey et al. (32,33). However, it is not yet clear that this change is so evident as far as the "double standard" of sexual morality within marriage is concerned (1). The cultural and social expectations of marriage and of marital fidelity are enormously varied across human societies (34), and these variations will effect how environmental factors impinge on sexual health. Such factors may be particularly important in sub-Saharan Africa contributing to the high prevalence of sexually transmitted disease and its associated reproductive morbidity in that part of the world (35).

Suggestions for Research

It should now be apparent that for most of the issues discussed in this paper we have little evidence other than anecdotal or indirect. In industrial settings where potentially toxic substances are being used, it would be appropriate to include careful assessment of sexual functioning in any study of adverse health consequences. However, such an enquiry should be carefully designed and executed if it is to have any validity.

The cross-cultural aspect is of fundamental importance, and there is a need for appropriate cross-cultural studies to assess the relative impact of cultural factors on the environmental effects. An appropriate place to start such an enquiry would be to assess the effect of work timetables on sexual relationships, across several contrasting cultural settings (e.g., assessing the marital and sexual relationship of couples where one or both partners are on shift work, or on night shifts). The methodological issues in carrying out such studies cross-culturally are substantial and will require some ground work at the outset. When we begin to acquire some understanding of the relevance of such cultural differences we will be in a stronger position to assess other environmental or occupational influences on sexual health. Clearly it will be important in such studies to control for factors such as affluence, climate, family size, and social expectations and values about male-female relationships and fertility.

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